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THE ENERGY DEPENDENCE OF THE OPTICAL-MODEL POTENTIAL FOR FAST-NEUTRON SCATTERING FROM BISMUTH*

by

A. B. Smith, P. T. Guenther and R. D. Lawson

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Applied Physics Division
Argonne National Laboratory
9700 South Cass Avenue
Argonne, Illinois 60439
USA

ABSTRACT

Neutron differential-elastic-scattering cross sections of bismuth were measured at ≈ 0.5 MeV intervals from ≈ 4.5 to 10.0 MeV. At each incident energy ≥ 40 differential values were obtained, distributed been ≈ 18^{o} and 160^{o}. The measured data were combined with lower-energy results previously reported from this laboratory, and others available in the literature, to provide a detailed data base extending from ≈ 1.5 to 10.0 MeV. This data base was interpreted in terms of the conventional optical-statistical model and also a model inclusive of the surface-peaked real potential predicted by the dispersion relation. Particular attention was given to the energy dependence of the volume-integral-per-nucleon of the real potential, J_v, to see if there was evidence of the Fermi Surface Anomaly. In the range 3.0 to 10.0 MeV the present data indicate that dJ_v/dE is essentially constant, with a relatively large negative value of -6.0 to -9.0 fm^3, depending on the model used in the analysis. Below 3.0 MeV, there is some evidence for a decrease in the magnitude of dJ_v/dE. However, the effect is very small and it is only when this trend is combined with considerations of the J_v values needed to give correct

bound-state energies that evidence for the Fermi Surface Anomaly emerges. J_v and the geometry of the optical potentials found for ^{209}Bi become equal to those needed to explain the high-energy ^{208}Pb data at about 10.0 MeV. Since dJ_v/dE for the latter is smaller in magnitude than for ^{209}Bi, a change in dJ_v/dE is clearly indicated near 10.0 MeV. This may effect the extrapolation of higher-energy and charged-particle potentials into the lower-energy neutron domain.

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